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ART UNIT	**PAPER NUMBER**
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/577,034	KIM ET AL.	
	Examiner	Art Unit	
	MARIA L. SEKUL	4124	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *18 March 2009*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-31* is/are pending in the application.

4a) Of the above claim(s) *11-25 and 27-31* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-10 and 26* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *24 April 2006* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *23 Jan 2007, 24 Apr 2006*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Election/Restrictions

1. Applicant's election without traverse of Group I (claims 1-10 and 26) in the reply filed on March 18, 2009 is acknowledged. Claims 11-25 and 27-31 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected invention, there being no allowable generic or linking claim. Election was made **without** traverse in the reply filed on March 1, 2009.

Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48(b) if one or more of the currently named inventors is no longer an inventor of at least one claim remaining in the application. Any amendment of inventorship must be accompanied by a request under 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(i).

Claim Objections

2. **Claims 1-10 and 26** are objected to because of the following informalities:

As to **claims 1-9 and 26**, each of the claims states either of the following phrases: "inserting pilot subcarriers into each symbol" or "pilot subcarriers are inserted". Pilot subcarriers cannot be inserted into symbols, but rather pilot symbols may be inserted into a subcarrier. For purposes of examination, these terms will be interpreted as "inserting pilot symbols into each subcarrier" or "pilot symbols are inserted". Appropriate correction is required.

As to **claim 5**, it is further objected to because "the minimum subcarriers" has no antecedent basis. For purposes of examination, “the minimum subcarriers” has been interpreted to mean "the subcarriers allocated in the case of adjacent cells".

As to **claim 7 and 8**, the claims do not end with a period (“.”). Please make the appropriate correction.

As to **claim 9,** in lines 1 and 2, it recites the limitation "the position set of pilot subcarriers". There is no antecedent basis for this limitation in the claim. For purposes of examination, these terms have been interpreted as “a position set of pilot subcarriers”. Please make the appropriate correction.

As to **claim 10**, line 6, recites “the downlink frame". The term has no antecedent basis. It seems that this term was meant to be “a downlink signal” and the claim has been interpreted as such. If this is the case, please replace “the downlink signal" with - - - a downlink frame - - - .

Claim Rejections - 35 USC § 112

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. **Claims 7 and 8** are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

As to **claims 7 and 8,** the mathematical equation embedded in the claim:

“K = {tiC, 0, fif, 17 -7 fK, gNpl} lii (k) = v (k) + (ik) modg 11 = {, J = + (. 9 () +j) modg}”

does not make sense. For purposes of examination, the formula has not been considered.

Claim Rejections - 35 USC § 102

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

6. **Claim 1 and 2** are rejected under 35 U.S.C. 102(e) as being anticipated by **Li et al. (US PGPub US 2002/0159422)** (hereinafter Li).

As to **Claim 1**, Li discloses a method to be used in "an orthogonal frequency division multiplexing access-frequency division duplexing (OFDMA-FDD) mobile communications system" (Li discloses a system with an OFDM transmitter for generating OFDM signals in a wireless communications network where the system may be a FDD system (OFDM transmitter with frequency division duplexing (FDD) duplexer, **Fig. 3, ¶ 45-46;** downlink and uplink transmission is arranged through FDD, **(¶ 75**); and

"(a) configuring a downlink frame with a plurality of symbols" (transmitter using OFDM for downlink communications; **Fig. 4 (¶ 50);** the transmission is made up of symbols generated by performing the encoding process **; ¶ 52)**.

"(b) inserting pilot subcarriers into each symbol to be distributively arranged therein with respect to a time axis and a frequency axis" (**Fig. 2** describes OFDM subcarrier clusters and pilot symbols in a time-frequency domain) ;

and "part of pilot subcarriers being reference for a mobile station to perform time synchronization, frequency synchronization and cell search" (pilot symbols can serve multiple purposes: time and frequency synchronization, channel estimation and SINR ratio measurement, **¶ 82**).

As to **Claim 2**, Li discloses a method for configuring a downlink signal in an orthogonal frequency division multiplexing access-time division duplexing (OFDMA-TDD) mobile communication system" (Li discloses a system with an OFDM transmitter to generate OFDM signals using a time switch for time division duplexing (TDD) duplexer, **Fig. 3, ¶ 45-46**); comprising:

"(a) configuring a downlink frame with a plurality of symbols"(the transmission is made up of symbols generated by performing the encoding process **; ¶ 52**), "the downlink frame and a seamless frame forming a frame of the mobile communication system (TDD supports full duplex communication, or other systems in which communication in both directions is in the same frequency, **¶ 45**; and the downlink and uplink transmission is arranged through TDD, **¶ 75**); and

"(b) inserting pilot subcarriers into each symbol to be distributively arranged therein with respect to a time axis and a frequency axis" (**Fig. 2** describes OFDM subcarrier clusters and pilot symbols in a time-frequency domain); and

"part of pilot subcarriers being reference for a mobile station to perform time synchronization, frequency synchronization, and cell search" (pilot symbols can serve multiple purposes: time ad frequency synchronization, channel estimation and SINR ratio measurement, **¶ 82**).

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to

consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

8. **Claim 3 and 26** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Li et al. (US PGPub US 2002/0159422)** (hereinafter Li), as applied in claim 1, and further in view of **Kleider et al. (US 6,487,252)** (hereinafter Kleider).

As to **Claims 3 and 26**, Li discloses all of claim 1.

Li further discloses that "the pilot subcarriers are inserted at regular intervals with respect to time domain" (pilot symbols have a fixed duration followed by a fixed number of data periods, **¶ 42**).

Li does not disclose pilot symbols are "inserted at irregular intervals with respect to frequency domain".

Kleider teaches unequal spacing of the pilot tones with respect to frequency in an OFDM system (**col. 6, line 59 through col. 7, line 7**).

Kleider and Li are analogous art in that they pertain to assigning pilot symbols in OFDM systems. It would have been obvious to one skilled in the art at the time the invention was made to use the method of assigning pilots unevenly with respect to frequency with the method of equal spacing as to time as taught by Li being that, according to Kleider, (col. 3, line 65 through col. 4, line 7), the less pilots that are used the more the spacing is uneven, and less pilot tones may be a result of improved signal to noise ratio or reduced bit error rate.

9. **Claims 4 and 5** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Li et al. (US PGPub US 2002/0159422)** (hereinafter Li) in view of **Kleider et al. (US**

6,487,252) as applied to claim 3 above, and further in view of **Baum et al. (US Patent 5,867,478)** (hereinafter Baum).

As to **Claim 4**, Baum discloses "wherein the pilot subcarriers are inserted according to position sets of pilot subcarriers proper to cells". Baum describes a pilot codes are inserted according to the pilot codes allocated to the cells (**Fig. 3; col. 6, lines 39-45**).

Baum and Li in view of Kleider are analogous art in that they pertain to assigning pilot codes in an OFDM system. It would have been obvious to one skilled in the art at the time the invention was made to use the pilot allocation mechanisms in Baum with the pilot usage in Li in view of Kleider in order to maintain orthogonality and avoid code collisions, as described in Kleider, col. 7, lines 18-20.

As to **Claim 5**, Li discloses all of claim 4,

Li does not disclose "wherein proper position sets of pilot subcarriers are allocated in the case of adjacent cells, and position sets of pilot subcarriers are allocated so that the minimum subcarriers may be superimposed in the case of non-adjacent cells when the number of cells is greater than an available number of the proper position sets of pilot subcarriers".

Baum discloses allocation of pilot codes in cells (Fig. 3) in which pilot codes are assigned to cells, and a re-use scheme in which pilot codes can be re-used in sectors which are not in adjacent cells. The pilot code reuse means the pilot code length does not need to be as large as the number of cells in the system (col. 6, lines 44-58).

It would have been obvious to one skilled in the art at the time the invention was made to use the allocation and re-use scheme of Baum with the method of using pilots in Li in view of Kleider in order reduce overhead by re-using the pilot codes in non-adjacent cells, as indicated in Kleider, col. 6, lines 55-56.

10. **Claim 6-8** is rejected under 35 U.S.C. 103(a) as being unpatentable over **Li et al. (US PGPub US 2002/0159422)** (hereinafter Li) in view of **Kleider et al. (US 6,487,252)** in view of **Baum et al. (US Patent 5,867,478)** (hereinafter Baum) as applied to claim5, and further in view of **Smee et al. (US PGPub 2004/0131007)** (hereinafter Smee).

As to **claim 6,** Li in view of Kleider in view of Baum discloses all of claim 5.

Li in view of Kleider in view of Baum does not disclose that the "proper pilot subcarriers corresponding to a predetermined number generated by dividing the number of subcarriers by the number of cells are allocated for each cell".

Smee teaches predetermining the number of pilots by partitioning the usable subbands (subcarriers) for pilot transmission where the number of usable subbands is divided into groups or sets which are allocated to different sectors/cells (**Fig. 2A-2B, ¶ 44-49),** and the number of sets to form depends on the size of the cluster (number of cells) for which frequency orthogonality is desired (**Fig. 3A, ¶ 55-56**).

Smee also teaches "as to insufficient pilot subcarriers, the cells are divided into cell groups including cells, and part of the proper pilot subcarriers are allocated to the cells which have the same position in different groups to configure a position set of pilot subcarriers for each cell" . **Fig. 5** teaches that the total number of cells are divided into

cell groups (*see* the shaded area of Fig. 5) and that the allocated pilots are reused in the other cell groups in the same positions.

Smee in view of Li in view of Kleider in view of Baum are analogous art in that they pertain to the allocation of pilot symbols/subcarriers in an OFDM system. It would have been obvious to one skilled in the art at the time the invention was made to use the method of pilot allocation in Smee with the pilot allocation method in Li in view of Kleider in view of Baum being that it allows reuse of pilots while maintaining orthogonality of the pilots.

As to **claim 7**, Smee further teaches "as to a prime number which is less than a value generated by dividing the number Nu of subcarriers by the number Np of subcarriers included in the cell group". Smee teaches a cluster of cells comprised of sectors formed into cell groups (**Fig. 3A**), and that a cluster may include any number of cells, including 1, 2, 3, 7 or 19 cells which are all prime numbers (**Fig. 3A** shows 3 cells in the group). **¶ 47** and **Table 2** show the calculation of the pilots where the total subbands (450) are divided by the number of subbands in the cell group (50) to form sets.

Smee further teaches "a predetermined number of cells (less than the prime number) are combined to be a plurality of cell groups" (Table2 shows the predetermined number of 3 cells in the group) , a default sequence specified by a cell group number of i is allocated to each cell group (a different scrambling code may be assigned to each sector, each cell, or each cluster which scrambling code may be a pseudo-random number (PN) sequence or some other unique sequence, **¶ 76**), , and the position set

of pilot subcarriers is allocated to each cell of cell groups according to the subsequent equations: K = {tiC, 0, fif, 17 -7 fK, gNpl} lii (k) = v (k) + (ik) modg 11 = {, J = + (. 9 () +j) modg} where K is a set of subcarriers for transmitting pilot subcarriers, v (k) is a specified pseudo random sequence having values of from 0 to (g-l), and is a set of pilot subcarriers having the cell group number of i and the cell number" (the sets of pilot subbands are assigned to the each cell, see **Fig. 3A, ¶ 76**).

For the reasons stated above for claim 5, it would have been obvious to one skilled in the art at the time the invention was made to combine the pilot allocation scheme in Smee with the pilot allocation scheme in Li in view of Kleider in view of Baum being that it allows reuse of pilots while maintaining frequency orthogonality and reducing interference (Smee, **¶ 43**).

As to **claim 8**, Smee further teaches "as to a prime number which is less than a value generated by dividing the number Nu of subcarriers by the number Np of subcarriers included in the cell group". Smee teaches a cluster of cells comprised of sectors formed into cell groups (**Fig. 3A**), and that a cluster may include any number of cells, including 1, 2, 3, 7 or 19 cells which are all prime numbers (**Fig. 3A** shows 3 cells in the group). **¶ 47** and **Table 2** show the calculation of the pilots where the total subbands (450) are divided by the number of subbands in the cell group (50) to form sets.

Smee further teaches "a predetermined number of cells (less than the prime number) are combined to be a plurality of cell groups" (Table2 shows the predetermined number of 3 cells in the group) , a default sequence specified by a cell group number of

i is allocated to each cell group (a different scrambling code may be assigned to each sector, each cell, or each cluster which scrambling code may be a pseudo-random number (PN) sequence or some other unique sequence, **¶ 76**), , and the position set of pilot subcarriers is allocated to each cell of cell groups according to the subsequent equations, and the pilot subcarriers are not punctured and transmitted at a position other than the position of subcarriers used for transmission to the mobile station (**Fig. 2B** shows the pilots are transmitted only on the subband allocated for transmission without puncturing). K = {tiC, 0, fif, 17 -7 fK, gNpl} lii (k) = v (k) + (ik) modg 11 = {, J = + (. 9 () +j) modg} where K is a set of subcarriers for transmitting pilot subcarriers, v (k) is a specified pseudo random sequence having values of from 0 to (g-l), and is a set of pilot subcarriers having the cell group number of i and the cell number" (the sets of pilot subbands are assigned to the each cell, see **Fig. 3A, ¶ 76**).

For the reasons stated above for claim 5, it would have been obvious to one skilled in the art at the time the invention was made to combine the pilot allocation scheme in Smee with the pilot allocation scheme in Li in view of Kleider in view of Baum being that it allows reuse of pilots while maintaining frequency orthogonality and reducing interference (Smee, **¶ 43**).

11. **Claim 9** is rejected under 35 U.S.C. 103(a) as being unpatentable over **Li et al. (US PGPub US 2002/0159422)**, as applied to claim 2 above, in view of **Baum et al. (US Patent 5,867,478)** (hereinafter Baum)**.**

As to **Claim 9**, Li discloses all of claim 2.

Li does not explicitly disclose “wherein the position set of pilot subcarriers applied to the downlink frame is established to be different from the position set of pilot subcarriers applied to the frame in order to identify the downlink frame and the frame”.

Baum teaches a different pilot code scheme can be used for uplink transmission than the pilot code scheme for downlink transmission (**col. 22, lines 51-54**).

Baum and Li are analogous art in that they both deal with generating OFDM downlink signals and pilot code usage in a TDD system. It would have been obvious to one skilled in the art at the time the invention was made to use different pilot code sequence in the uplink transmission different from the downlink reception in order to distinguish which the uplink and downlink portions of the frame.

12. **Claim 10** is rejected under 35 U.S.C. 103(a) as being unpatentable over **Dubuc et al. (US Patent No. 7,251,291)** (hereinafter Dubuc) in view of **Smee et al. (US PGPub 2004/0131007)** (hereinafter Smee).

As to **claim 10**, Dubuc discloses:

“a pilot generator for generating a pilot symbol pattern" (**Fig. 2** shows a pilot signal generator), and

“a symbol mapper for mapping external input traffic data information with respect to time and frequency based on the pilot symbol pattern and the position set pattern of pilot subcarriers generated by the pilot generator” (**Fig. 2** shows the generated pilot being input to a symbol mapper which is then input into the time and frequency converter), and

"the pilot symbol pattern being inserted into symbols when the downlink frame includes the symbols" and "including a plurality of pilot subcarriers which are distributively arranged with respect to the time axis and frequency axis for each symbol" (**Fig. 2** shows the pilot symbols being mapped into symbols and arranged with respect to time and frequency for each symbol; **Fig. 6** shows OFDM frames made up of symbols, including pilot symbols);

"outputting mapped signals to a transmitter of the mobile communication system" (**Fig. 2** shows the mapped signal being sent to the transmitter interface); and

the pilot signals "are references for a mobile station to perform time synchronization, frequency synchronization, and cell search" (**Fig. 4** shows a receiver using the pilot to perform channel estimation and synchronization with the cell).

Dubuc does not teach the pilot symbol pattern is "according to external cell number information and a position set pattern of pilot subcarriers" and "the position set pattern of pilot subcarriers being proper to each cell".

Smee teaches the pilot allocation scheme in which a set of pilots for each cell are predetermined and are assigned ("proper") to cells (**Fig. 2B, ¶ 46-49; Fig 3A, ¶ 56**). The allocation of pilot signals may be used by the pilot generator described in Dubuc.

Smee and Dubuc are analogous art in that they both deal with pilot generation and allocation. It would have been obvious to one skilled in the art at the time the invention was made to combine the pilot allocation method in Smee with the pilot generation method in Dubuc in order for the pilot generator to know which pilot signals to generate for that cell and for the user to know which pilot signals belong to the cell.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to MARIA L. SEKUL whose telephone number is (571)270-7636. The examiner can normally be reached on Monday - Friday 8:00-5:30 EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Lewis West can be reached on (571) 272-7859. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

MARIA L. SEKUL
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